a physical gel without leaking. This physical gel was then transformed into a chemical gel.

	Concentration of AB4N2SH polymers (% w/v)			
Regelled hydrogels	5	7	9	11
	Static modulus (Pa)			
RAB4N2SS	375	428	734	1008

Example 3

Hydrogels as Vitreous Substitute

The copolymer (AB4SH) was prepared from the hydrogel obtained by polymerizing acrylamide with 4 acrylic mole % of bisacryloylcystamine (BAC). The detailed experimental procedure was similar to those described in Example 1.

A 7% (w/v) solution AB4SH was prepared in water (N_2 saturated) initially at pH ~4 and after the complete dissolution, the pH was adjusted to 7 using 15 μL of 1 M NaOH. After which, 62 μL of 0.5M DTDP (pH=7) was added. The total volume of the composition was 1 ml and injected into pre-evacuated human cadaver eye vitreous cavity. The in-situ gel equilibrated with the residual water in the vitreous cavity thus making the final composition of the gel inside the cavity substantially less than 7% (FIG. **8**). However, in general, gels containing higher percentage of BAC require lower concentration to gel and preferable as vitreous substitute.

In the current studies, acrylamide is employed as a monomer to be copolymerized with BAC, but other acrylamides or vinylmonomers can also be used. This technique of introducing pendant thiols into the polymer, along with appropriate choice of the primary polymer, can be used to design gels for specific end uses. Although much effort has been spent to develop biocompatible hydrogels, this reversible hydrogel system has not been previously investigated for in situ medical applications. Collectively, these observations indicate that this system is novel.

Although certain presently preferred embodiments of the invention have been specifically described herein, it will be apparent to those skilled in the art to which the invention pertains that variations and modifications of the various embodiments shown and described herein may be made without departing from the spirit and scope of the invention. Accordingly, it is intended that the invention be limited only to the extent required by the appended claims and the applicable rules of law.

What is claimed is:

1. A method of forming a replacement intraocular lens in situ in an eye comprising the steps of

a) introducing a reversible hydrogel system in solution into the capsular bag, wherein the reversible hydrogel system comprises a copolymer, wherein said copolymer is a hydrogel when in an oxidized state, and is a solution when in a reduced state, and wherein said copolymer is produced by polymerization of a monomer with a disulfide crosslinker, said monomer being selected from the group consisting of acrylamide, N-ornithine acrylamide, N-(2-hydroxypropyl)acrylamide, hydroxy-ethylacrylate, hydroxyethylmethacrylate, polyethyleneglycol acrylates, polyethyleneglycol methacrylates, N-vinyl pyrrolidone, N-phenylacrylamide, dimethylaminopropyl methacrylamide, acrylic acid, benzylmethacrylamide, and methylthioethylacrylamide; and

b) gelling the reversible hydrogel system.

2. The method of claim **1**, wherein the crosslinker is N, N'-bis(acryloyl)cystamine.

3. The method of claim **2**, wherein the oxidization occurs at a pH of about 6.5 to about 7.5.

4. The method of claim **2**, wherein the hydrogel is hydrophobic.

5. The method of claim **2**, wherein the hydrogel is hydrophilic.

6. The method of claim **2**, wherein the hydrogel is anionic.

7. The method of claim **2**, wherein the hydrogel is cationic.

8. The method of claim **2**, wherein the hydrogel can be reduced by the addition of a reducing agent.

9. The method of claim **8**, wherein the reducing agent is selected from the group consisting of dithiothreitol (DTT), 2-mercaptoethanol, dithioerythritol, cysteine, butanethiol, sodium borohydride, cyanoborohydride, mercaptoethylamine, ethylmaleimide, and tri(2-carboxyethyl)phosphine hydrochloride (TCEP.HCl).

10. The method of claim **2**, wherein the solution can be oxidized by atmospheric oxygen.

11. The method of claim **1**, wherein the reversible hydrogel system comprises a drug or particles.

12. The method of claim **11**, wherein the particles are proteins, polymers, or inorganic compounds.

13. The method of claim **11**, wherein the particles are nanoparticles.

14. The method of claim **13**, wherein the nanoparticles have sizes from about 4 nanometers (nm) to about 100 nm.

15. The method of claim **13**, wherein the nanoparticles do not scatter visible light.

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